GIANT MASCOT MINES LIMITED

NINETEENTH ANNUAL REPORT 1969

GIANT MASCOT MINES LIMITED

(Incorporated under the Laws of the Province of British Columbia)

Listed on the Vancouver and Toronto Stock Exchanges

NINETEENTH ANNUAL REPORT

DIRECTORS
A. H. AINSWORTH, Vancouver
J. AUSTIN, Vancouver
K. G. BREAM, Vancouver
B. O. BRYNELSEN, Vancouver
M. E. DAVIS, Vancouver
J. L. GIBSON, Vancouver
W. C. GIBSON, Vancouver
H. A. McDIARMID, Vancouver
L. P. STARCK, Vancouver

OFFICERS
W. C. GIBSON, Chairman of the Board
J. AUSTIN, President
L. P. STARCK, Vice-President and Managing Director
M. E. DAVIS, Vice-President, Finance
A. H. AINSWORTH, Secretary
S. CLARKE, Treasurer

REGISTERED OFFICE
625 - 925 West Georgia Street, Vancouver

ADMINISTRATIVE OFFICE
7th Floor, 1177 W. Hastings St., Vancouver

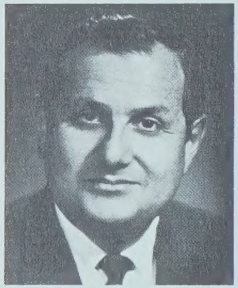
REGISTRAR AND TRANSFER AGENTS
Canada Permanent Trust Company, Vancouver and Toronto

GENERAL COUNSEL
Ainsworth, Henson, Norby, Purvis & Kendall, Vancouver

AUDITORS
Thorne, Gunn, Helliwell & Christenson, Vancouver

Annual General Meeting March 31, 1970, 3:00 p.m., Hotel Vancouver, Vancouver, B.C.

REPORT OF THE PRESIDENT AND DIRECTORS TO THE SHAREHOLDERS



On behalf of the Board of Directors I am pleased to make this Nineteenth Annual Report to the shareholders for the fiscal period ended September 30, 1969, and for the Annual Report period from February 1, 1969, to this date. During the 14 months since the last Annual General Meeting a number of important events have occurred.

Through the superb efforts of the Managing Director, L. P. Starck, the General Manager, Frank Holland, and the mine team, a subsidence which took place in November, 1968, and greatly interrupted production, was recovered from by mid-1969. With excellent co-operation everywhere we were able to make the same financial performance during the latter part of the 1969 fiscal period ended September 30th as we made in the whole of our 1968 year when no unusual operating problems occurred.

The first fiscal quarter of the 1970 financial period which is from October 1 to December 31, 1969, has given the Company gross earnings of $846,240, which is only $21,692 less than the gross earnings (before income and mining taxes) for the whole of the 1969 fiscal year. This outstanding performance demonstrates the real momentum being gained at the Giant Nickel mine, and in particular the improved grade of ore being milled.

Shareholders will note that near the end of November, 1969, the Inco posted price for electrolitic nickel was moved up from $1.03 U.S. to $1.28 U.S. Very little of this price is in fact reflected in the results of this first fiscal quarter of 1970 and the major impact will not be shown until the results of the second fiscal quarter ending March 31, 1970, become available.

A determined effort is being made underground at the Giant Nickel property to develop reserves sufficient to allow an increase in milling capacity to a targeted 3,000 ton per day operation which would roughly double the present size. The outcome of this new underground program will not likely be available until towards the end of the calendar year 1970. It is significant to note that only about 10% of the favorable area for the occurrence of mineralization at the Giant Nickel property has received exploration attention up to this time.

Giant Mascot has had continuous relations with Sumitomo in Japan for more than ten years during which time Sumitomo has purchased all of the nickel-copper concentrate production of the Company. The last Concentrate Sales Agreement with Sumitomo expired February 28th, 1970, but a new Agreement for a further term of three years to

February 28th, 1973, will shortly be concluded under the provisions of a Letter of Intent dated December 12th, 1969, and signed by myself as President and by Mr. L. P. Starck as Managing Director of the Company, after negotiations lasting over a period of some three months.

The provisions of the new Concentrate Sales Agreement will almost certainly enhance the earnings of this Company. We expect the current levels of nickel pricing to be maintained and improved, and through arrangements embodied in the Letter of Intent, Giant Mascot will also be able to enjoy a portion of the merchant nickel price in addition to payments for concentrates. Details of the arrangements can not be released until all of the various mechanics are settled between the Company and Sumitomo and formally approved by the Japanese Government.

The Giant Copper property responded very well to the 1969 exploration program and will receive accelerated exploration during 1970. A potential of upwards of 12,000,000 tons grading in the order of .70% copper with significant values in precious metals will be the immediate objective, but with the addition of two new areas of interest, the "20 mile Grid" 2500 feet southwest and the "10 Level Grid" 2500 feet northeast of the main A.M. breccia zone, there is the possibility that even more substantial tonnage might be developed. Follow-up work in this direction will also be a main objective of our 1970 exploration program.

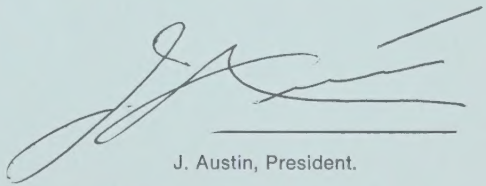
At the conclusion of the last Annual General Meeting on January 31, 1969, Messrs. B. O. Brynelsen, P.Eng., Kenneth Bream, M.B.A., and Allan H. Ainsworth, B.C.L., were welcomed to their first meeting as Directors following their election to the Board. Mr. Brynelsen is Chairman of the Board of Brameda Resources Limited and widely known in mining circles in Canada. Mr. Bream is Vice-President and General Manager of Pacific Centre Limited and is responsible for the construction of a major real property development in downtown Vancouver. Mr. Ainsworth has been Secretary of the Company for several years and is one of Vancouver's senior legal counsel.

At the same Directors' meeting of January 31, 1969, W. Clarke Gibson became Chairman of the Board, J. Austin President, L. P. Starck Managing Director and M. E. Davis Vice-President, Finance, of the Company. The same gentlemen were also elected as the members of the Executive Committee of the Company.

I can not conclude this report without expressing my personal delight at the high degree of working efficiency developed in this Company from the Board of Directors through every level of our operations. I very much enjoyed my first year as President of the Company. I am particularly grateful to W. Clarke Gibson for his experienced guidance in the affairs of the Company and to L. P. Starck for an outstanding performance. Mr. Starck's report to the President and the Board of Directors appears in this Annual Report.

The Board of Directors believes that in the absence of unexpected events the current fiscal year will be an outstanding one in new levels of earnings and new levels of performance at the Giant Nickel mine. Nickel and copper are two metals very much in demand in world commerce today. We believe that the demand will continue to be steady at acceptable prices for the whole of 1970 and beyond.

ON BEHALF OF THE BOARD,



J. Austin, President.

Vancouver, B.C.
March 6, 1970.

President and Directors,
Giant Mascot Mines Limited,
7th Floor, 1177 W. Hastings Street,
Vancouver 1, B.C.

Gentlemen:

Record proceeds from concentrate sales, the establishment of ore reserves at the highest level since the commencement of operations and the development of geological information considered highly significant for the future potential of both the Giant Nickel operation and the Giant Copper property made 1969 a rewarding year.

Net Smelter Returns and Income

NET SMELTER RETURNS

	Per Year	*Per Ton*
1969	$3,469,505	$10.95
1968	3,076,926	9.09
1967	3,453,992	10.36

OPERATING PROFIT

	Per Year	*Per Ton*
1969	$1,591,225	$ 5.02
1968	1,218,849	3.61
1967	1,490,432	4.47

NET PROFIT

	Per Year	*Per Ton*
1969	$ 557,264	$ 1.75
1968	531,955	1.57
1967	815,767	2.44

Increased prices for nickel and copper are reflected in greater net smelter returns and operating income. The improvement in operating income more than offsets the costs of major development work undertaken during the year on the 4600, 4400 and 4300 ore zones. In the result, the net income after writing off, in accordance with past practice, 100% of such major development costs was still somewhat greater than reported for 1968.

Production

	1969	*1968*	*1967*
Ore treated (tons)	316,749	338,340	333,546
Nickel-copper concentrates produced (tons)	17,527	18,227	22,786
Nickel recovered (pounds)	3,496,000	3,769,519	4,752,936
Copper recovered (pounds)	1,930,339	1,417,703	1,998,577
Grade of ore treated: % Nickel	0.72	0.675	0.855
Grade of ore treated: % Copper	0.34	0.23	0.31

The tonnage treated during the year was lower than in previous years due to the curtailment of production following the subsidence in the Brunswick No. 2 area in November, 1968. In addition, the normal mining sequence was disrupted, and to maintain production ore was drawn from lower grade areas with the result that the grade of the ore treated during the year was lower than that indicated by the 1968 ore reserve estimates.

Operating Costs

	1969	*1968*	*1967*
Mining	$2.82	$2.74	$3.00
Concentrating	1.48	1.24	1.29
Administration	0.67	0.57	0.51
Development and exploration	1.14	1.01	1.12
	$6.11	$5.56	$5.92

Higher operating costs reflect increased labour and supply charges. Although the administration costs, which include insurance, property taxes, transfer agency charges, legal and auditing fees, etc., appear to be higher, they reflect a consolidation of such costs for Giant Mascot and all its subsidiary companies including Giant Soo Mines Limited (N.P.L.).

Ore Reserves and Exploration

	1969	*1968*	*1967*
Tons	1,088,266	897,241	859,834
% Nickel	0.94	0.96	0.83
% Copper	0.52	0.52	0.33

The proven and probable ore reserves, after making normal allowances for dilution and extraction, increased 21.3% to 1,088,266 tons, giving the highest ore reserves in the 10 year history of the Giant Nickel operation.

Since July, 1959, 3,159,038 tons of ore have been mined grading 0.81% nickel and 0.32% copper. It is significant that the 4,247,304 tons by way of the total of the tonnage extracted to date plus the tonnage of the current ore reserves is 5½ times the ore reserves known at the time the Company took control of the property. It is perhaps equally significant that these 4,247,304 tons of ore have been found entirely in that small area of the favourable ultra-basic formation which has been explored to date above the 2600 level. The downward extensions of the known ore zones have not been tested below the 2600 level.

A large percentage of the present ore reserves has been blocked out in the new 4600 zone where in excess of 750,000 tons has been delineated between the 2950 and 3550 levels.

Diamond drilling is in progress to further expand this zone, both above and below present limits and to test for the extensions of the 4300 zone and the 4400 zone. Other promising new areas of mineralization are being explored in the 1800, 2000, and 2660 areas.

In addition to normal ore development exploration, a 50,000 foot long hole diamond drilling program was commenced in June on the 3550 and 3275 levels to explore the ore-hosting ultrabasic formations beyond the limits of the main mine operations. Valuable geological information is being obtained in the course of this program which it is expected will lead to the locating of new ore bodies. The width of favourable ultrabasic rocks in the Brunswick-Pride of Emory areas, has been found to be 1,850 feet, 500 feet greater than previously assumed. No major ore zones have been located by this work, but sections of low grade mineralization have been encountered and a promising short intersection of above mine run grade was intersected in virgin ground north of the Pride of Emory.

Mining

	1969	*1968*	*1967*
Raising (feet)	4,962	3,676	3,303
Drifting (feet)	3,451	3,422	1,448
Longholding (feet)	191,990	167,283	265,905
Diamond drilling (feet)	55,077	48,965	56,077

The major portion of the 1.4 miles of development work and 10.4 miles of diamond drilling was done to explore and develop the 4600, 4400 and 4300 zones, and to provide new ore passes and manways to service this new section of the mine.

At present, the 4600 zone is in partial production and the benefit of this higher grade ore will be fully apparent by mid-1970.

Most of the production during 1969 was derived from the 1500, 2200 and Brunswick 2G zones and development tonnage from the 4600 and 4300 areas.

Concentrator

Expansion of the flotation circuit and the fine ore storage has been completed. Plans for renovation and expansion of the crushing and grinding circuits is well advanced.

The nickel recovery was 78.3% and the copper recovery 90.3%.

Capital Expenditures

Capital expenditures totalled $384,698, of which $313,350 was for underground equipment, $11,059 for mill expansion, $9,619 for mobile equipment, $28,368 for new surface installations and the balance for miscellaneous items.

Outside Exploration

Surface geological and geophysical surveys were conducted on a group of 400 claims lying to the west of the Giant Nickel property. This work has been carried out as a joint venture with Giant Explorations Limited (N.P.L.), in which Giant Mascot hold a 25% interest. During the present year, further

exploration is planned by the joint venture. The Company also intends to carry out diamond drilling on the Giant Soo lead-zinc property at Wasa and the Nickel Plate gold-copper property at Hedley.

General

A letter of intent has been entered into with the Sumitomo Group for a three year sales contract, the terms of which are now being formalized.

Giant Copper Project

Further indications of the substantial potential of the Giant Copper property resulted from the exploration program which in 1969 consisted of surface geological, geochemical and geophysical surveys. Two entirely new anomalous areas, "20 Mile Grid" 2500 feet southwest, and the "10 Level Grid" 2500 feet northeast of the main A.M. breccia zone, were located. These anomalies are particularly interesting because they have structural features similar to those considered significant in localization of the A.M. breccia zone previously established. These anomalous zones, of course, constitute prime targets for the 1970 surface program, as do the Invermay and Tramline breccia zones.

Early resumption of underground work on the A.M. breccia zone is planned, commencing with a crosscut on the 1500 level to the southeast section, followed by raising and diamond drilling to establish vertical continuity of this zone. On the basis of a recent reassessment of the known mineralization the concept that the A.M. breccia zone, as a whole, comprises a large low grade copper deposit, is becoming increasingly more probable. Accordingly, the underground development program will be supplemented by diamond drilling of the central core of the zone inside the limits of previous drilling to obtain confirmation of the indicated grades and tonnages.

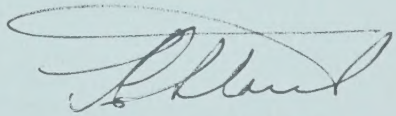
Conclusions

The expansion of the ore reserves at the Giant Nickel property during 1969, the renewal of the sales contract for a further three years and the present level of metal prices provide a sound basis for Giant Mascot's operations during 1970, and growing geological potential at both the Giant Nickel and the Giant Copper properties enhances the prospects for continuity and future growth.

Acknowledgment

The support of the President and Board of Directors and the effort and cooperation of the staff and employees is gratefully acknowledged.

Yours truly,



L. P. STARCK, P.Eng.,
Managing Director.

March 2, 1970.

GIANT MASCOT MINES LIMITED

(Incorporated under the laws of British Columbia)
and subsidiary companies

CONSOLIDATED BALANCE SHEET—SEPTEMBER 30, 1969

(with comparative figures at September 30, 1968)

ASSETS

	1969	1968
CURRENT ASSETS		
Cash	**$ 126,847**	$ 240,945
Short-term deposits	**1,312,202**	904,117
Accounts receivable		
Affiliated company	**4,350**	13,372
Other	**24,794**	34,741
Concentrate settlements receivable	**32,775**	58,547
Concentrates on hand, at estimated realizable value	**670,003**	156,606
Income and mining taxes refundable	**—**	34,878
Supplies on hand, at cost	**100,687**	96,147
Prepaid expenses	**63,131**	45,310
	2,334,789	1,584,663
SPECIAL REFUNDABLE TAX	**—**	25,678
INVESTMENT IN GIANT EXPLORATIONS LIMITED (N.P.L.), at cost (note 3)	**10,775**	10,775
MINING PROPERTIES AND DEVELOPMENT (note 4)	**3,586,676**	3,364,369
	$5,932,240	$4,985,485

LIABILITIES

CURRENT LIABILITIES	1969	1968
Accounts payable and accrued liabilities	$ 469,528	$ 360,855
Income and mining taxes payable	263,698	—
	733,226	360,855

SHAREHOLDERS' EQUITY

CAPITAL STOCK (note 5)		
Authorized		
7,500,000 Shares of no par value		
Issued		
4,693,728 (1968—4,677,728) Shares of no par value	4,273,848	4,256,728
CAPITAL DEFICIT	2,040,819	2,040,819
	2,233,029	2,215,909
RETAINED EARNINGS		
Balance at beginning of year	2,408,721	1,876,766
Net income for the year	557,264	531,955
	2,965,985	2,408,721
	5,199,014	4,624,630
	$5,932,240	$4,985,485

Approved by the Board,

J. AUSTIN, *Director*

L. P. STARCK, *Director*

CONSOLIDATED STATEMENT OF INCOME
YEAR ENDED SEPTEMBER 30, 1969

(with comparative figures for 1968)

	1969	1968
MINERAL PRODUCTION		
Value of concentrates produced, net of transportation and handling charges	**$3,469,505**	$3,076,926
COST OF PRODUCTION AND ADMINISTRATION		
Mining	**893,359**	936,648
Concentrating	**470,860**	428,352
Mining development	**360,852**	341,477
General and administrative	**218,454**	210,728
Depreciation	**257,784**	196,824
	2,201,309	2,114,029
MINE OPERATING INCOME	**1,268,196**	962,897
Add interest income	**65,245**	59,128
	1,333,441	1,022,025
DEDUCT		
Shaft rehabilitation	**28,810**	—
New level access	**417,988**	343,508
Investigation of other properties	**25,681**	2,854
	472,479	346,362
Income, before income and mining taxes	**860,962**	675,663
Income and mining taxes (note 2)	**303,698**	124,722
Income for the year, before adjustment of prior years	**557,264**	550,941
Adjustment to prior years' income and mining taxes	**—**	18,986
NET INCOME FOR THE YEAR	**$ 557,264**	$ 531,955

CONSOLIDATED STATEMENT OF SOURCE AND APPLICATION OF FUNDS
YEAR ENDED SEPTEMBER 30, 1969

(with comparative figures for 1968)

SOURCE OF FUNDS	1969	1968
Operations		
Net income for the year	**$ 557,264**	$ 531,955
Add depreciation, an item not involving a current outlay of funds	**257,784**	196,824
	815,048	728,779
Sale of equipment	**4,875**	4,581
Issue of capital stock	**17,120**	30,400
Working capital of subsidiary consolidated during the year, less cost of acquiring the minority's interest	**—**	114,747
Other	**29,528**	6,527
	866,571	885,034
APPLICATION OF FUNDS		
Additions to mineral claims, buildings, plant and equipment	**384,698**	140,183
Exploration and development at Giant Copper and other properties	**104,118**	317,325
	488,816	457,508
INCREASE IN WORKING CAPITAL	**377,755**	427,526
WORKING CAPITAL AT BEGINNING OF YEAR	**1,223,808**	796,282
WORKING CAPITAL AT END OF YEAR	**$1,601,563**	$1,223,808

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS YEAR ENDED SEPTEMBER 30, 1969

1. Basis of Consolidation

All subsidiary companies are included in the consolidated financial statements and all are wholly-owned. These companies are as follows:

G.M. Explorations Limited (N.P.L.)
Mascot Copper Mines Limited (N.P.L.)
Giant Soo Mines Limited (N.P.L.)

2. Accounting Policies

The accompanying accounts do not reflect any write-offs for depreciation of plant and equipment or exploration and development expenses relating to the Giant Copper property or the Hedley property as the properties are not yet in production. However, for income tax purposes maximum amounts of capital cost allowances and exploration expenses were utilized. As a result of this policy income tax expense for 1969 has been reduced by approximately $57,000 (1968—$158,000) and accumulated reductions to September 30, 1969, are approximately $521,000. It is considered unnecessary to provide for deferred income taxes resulting from this practice as other amounts not carried in the accounts are available to reduce taxable income when the Giant Copper property comes into production.

Depreciation on the assets at the operating nickel mine at Hope has been recorded at the maximum rates allowable for income tax purposes.

No depreciation has been recorded on the Giant Soo mine assets due to the cessation of operations.

Development costs of major access routes (new level access) in the operating nickel mine at Hope are written off as such amounts are expended although such development may benefit more than one fiscal period.

Concentrates on hand are included in income and current assets at estimated realizable value based on prices at the balance sheet date.

3. Investment in Giant Explorations Limited (N.P.L.)

The 500,255 shares held represent approximately twenty-five per cent of that company's issued shares.

4. Mining Properties and Development (i)

	1969	1968
Operating nickel mine at Hope		
Mineral claims and rights, at cost	$ 266,396	$ 268,057
Buildings, plant and equipment, at cost less proceeds of assets sold	2,235,956	1,847,328
Less accumulated depreciation	(1,421,875)	(1,168,992)
	1,080,477	946,393
Giant Copper property under development		
Mineral claims, at cost*	982,554	976,950
Plant and equipment, at cost*	370,858	370,858
*Including the value ascribed by the directors ($1,084,997) to 1,084,997 shares of capital stock issued therefor		
Exploration and development expenses, at cost	792,842	690,894
	2,146,254	2,038,702
Giant Soo property (ii)		
Mineral claims, at cost	20,000	20,000
Buildings, plant and equipment, at cost	299,847	321,347
Less accumulated depreciation	(64,984)	(64,984)
	254,863	276,363
Hedley property		
Option rights, at cost	3,193	2,513
Exploration and development expenses, at cost	101,889	100,398
	105,082	102,911
	$ 3,586,676	$3,364,369

(i) The amounts shown for mineral claims and rights and exploration and development expenses represent accumulated costs and are not intended to reflect present or future values.

(ii) This property ceased production on October 6, 1967, and consequently the accumulated provision for depreciation of the buildings, plant and equipment may not be adequate.
These mineral claims are subject to a 2½% royalty payable on net smelter returns.

5. Capital Stock

During the year the company issued 16,000 shares for $17,120 cash pursuant to stock options granted to certain officers and employees. No further options are outstanding.

6. Remuneration of Directors and Senior Officers

The total direct aggregate remuneration paid by the company to its directors and senior officers (including not only officers as such but also, by definition, certain management personnel) was $102,050 (1968—$92,700).

AUDITORS' REPORT

To the Shareholders of
Giant Mascot Mines Limited.

We have examined the consolidated balance sheet of Giant Mascot Mines Limited and its subsidiary companies at September 30, 1969, and the consolidated statements of income and source and application of funds for the year then ended. Our examination included a general review of the accounting procedures and such tests of accounting records and other supporting evidence as we considered necessary in the circumstances. In our opinion these consolidated financial statements present fairly the financial position of the companies at September 30, 1969, and the results of their operations and the source and application of their funds for the year then ended, in accordance with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

THORNE, GUNN, HELLIWELL
& CHRISTENSON,
Chartered Accountants.

November 7, 1969.

FIRST QUARTER OPERATING REPORT
1970 FISCAL PERIOD

7th Floor,
Board of Trade Tower,
1177 W. Hastings St.,
Vancouver 1, B.C.

To the Shareholders:

The Board of Directors presents the following statement on the operations of the Company for the three month period ended December 31, 1969, and for comparison, the three month period ended December 31, 1968.

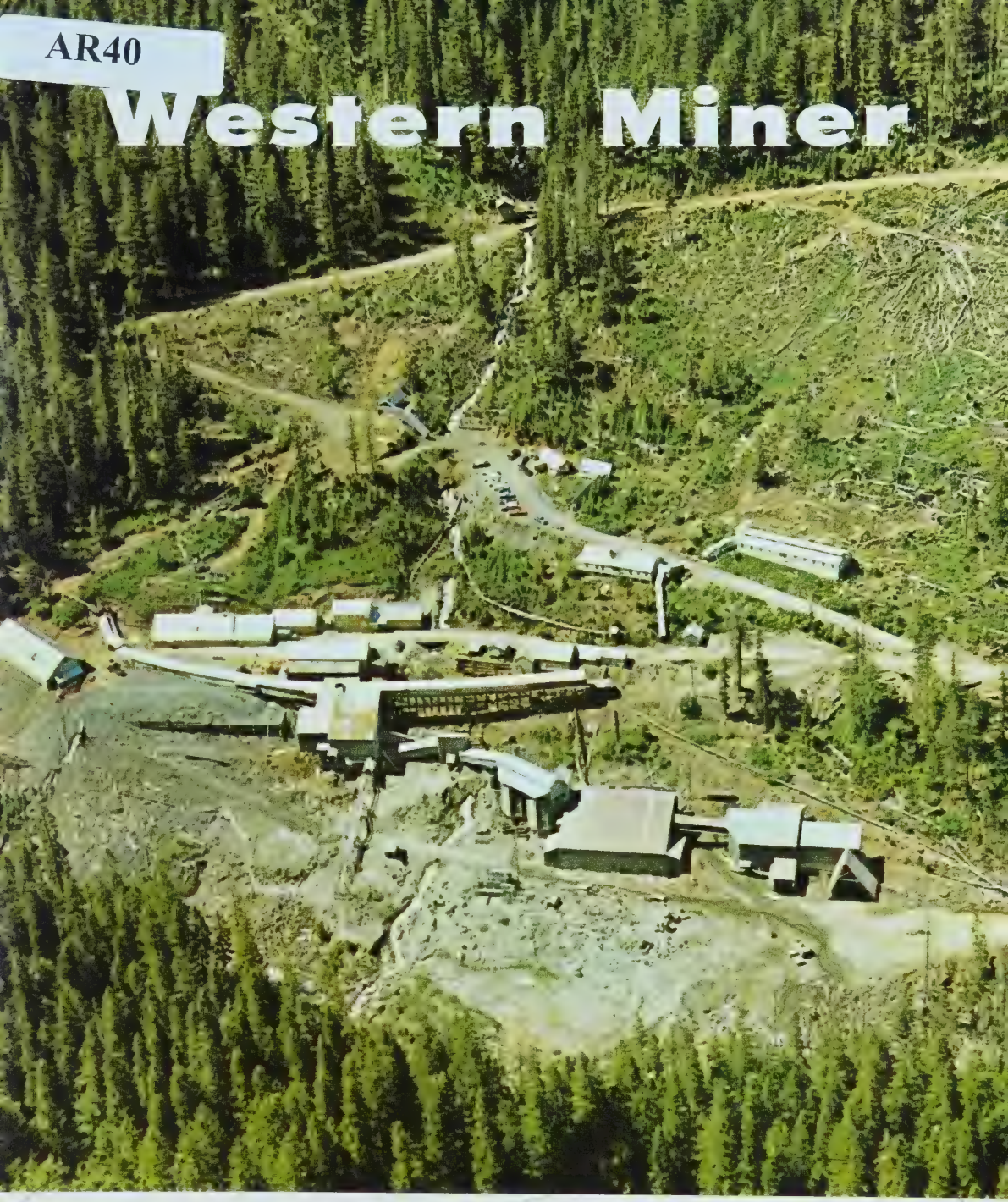
	3 months ended Dec. 31, 1969	*3 months ended Dec. 31, 1968*
Dry tons of ore milled	**88,385**	68,078
Net mineral production	**$1,363,039**	$ 598,260
Deduct:		
Mine operating expense	**227,064**	225,012
Mill operating expense	**117,632**	105,538
Exploration and development expense	**129,131**	80,311
Administrative expense	**62,308**	52,035
	$ 536,135	$ 462,896
Operating profit	**826,904**	135,364
Miscellaneous income	**19,336**	10,366
Profit before provision for depreciation and taxes	**$ 846,240**	$ 145,730
Capital expenditure	**$ 169,734**	$ 79,732
Exploration and development at Giant Copper and other properties	**$ 47,145**	$ 21,070

(Subject to audit and year-end adjustment.)

January 31, 1970.

GIANT MASCOT MINES LIMITED,
J. AUSTIN, President.

Western Miner



GIANT MASCOT MINES LIMITED

JUNE, 1969
Vol. 42 No. 6

Reprinted from Western Miner,
June, 1969, p.p. 34 and 37-46 inclusive

Mining Man of the Month

LOUIS PHILIP STARCK, B.A.Sc., P.Eng.

"Lou" Starck, the managing director of Giant Mascot Mines Limited, is a mining engineer with an enviable record of operating success.

He was born in Vancouver December 31, 1923. He received his public and high school education in Vancouver and graduated from The University of British Columbia in mining engineering in 1947, after which he did post-graduate work in metallurgy.

In the summers of 1946 and 1947 he was employed at Ollala by Hedley Monarch Mines. In 1948 he joined the staff of Canadian Exploration Limited at Salmo and for the following two years was assistant superintendent of the lead-zinc mill and superintendent of the tungsten mill. In 1950, he was exploration scout for the consulting firm of Hill, Legg, Hemsworth, and Grimwood. In 1951, he was sent to Spillimacheen to advise on operating problems at the Giant Mascot lead-zinc mine and within three months was made manager of the operation.

In the following four years, the Spillimacheen project prospered. In 1955, Mr. Starck returned to Vancouver to join the consulting firm of Henry L. Hill & Associates Ltd., which in 1959 became Hill, Starck & Associates Ltd. For several years the firm was consulting manager for Giant Mascot Mines, Silbak Premier Mines, Cronin Babine Mines, Trojan Consolidated Mines, Quatsino Copper-Gold Mines, and a number of other operating companies and as straight consultant to others in the exploration stage.

When Giant Mascot Mines purchased the B.C. Nickel mine and plant from Newmont Mining Corporation of Canada in 1959, Lou was drafted to handle the operating end and in following years maintained residence at the mine for a great deal of his time. The spectacular success of this reclamation and rehabilitation is widely known and is reported in some detail in this issue of Western Miner.

In 1965, Mr. Starck resigned from the consulting-engineering firm to become managing director of Giant Mascot Mines on a full-time basis. At the present time he is vice-president and managing director of Giant Mascot Mines; president of Giant Explorations Limited; and vice-president of Brameda Resources Ltd.

He is a member of the Institution of Mining and Metallurgy; the Canadian Institute of Mining and Metallurgy; the American Institute of Mining, Metallurgical, and Petroleum Engineers; and of the Association of Professional Engineers of British Columbia. With Mrs. Starck, he resides at 3958 Bayridge Court, West Vancouver, B.C.

A view of the Giant Mascot mill from the west.

Giant Mascot Mines Limited

AN ACHIEVEMENT OF RECORD

By FRED H. STEPHENS
Associate Editor, Western Miner

Since Giant Mascot Mines Limited commenced production at the property previously known as the "B.C. Nickel" mine in July 1959, the value of concentrates shipped has exceeded $27 million. For the first eight months nickel concentrate was shipped to the Fort Saskatchewan refinery of Sherritt Gordon Mines Limited and copper concentrate to the Tacoma smelter of American Smelting and Refining Company. In March 1960, Giant Mascot effected a sales contract with Sumitomo Metal Mining Co. Ltd. under which a bulk nickel-copper concentrate has since that time been shipped to Japan.

It must be borne in mind that payment received has been for concentrates. In terms of contained metal the value is estimated to be well over $40 million.

Giant Mascot purchased the property from Newmont Mining Corporation of Canada Limited at a cost of approximately one million dollars. The operation has provided dividends of $1.2 million, built up working capital of approximately the same figure, and paid almost $11 million in wages and salaries. At the same time, the company has expended $7½ million in the purchase of machinery, equipment, and services; with electric power ($1,250,000), explosives ($1,000,000), and drilling supplies ($600,000) being the principal items.

Funds generated by the Giant Mascot operations have also provided nearly one million dollars for the purchase, exploration, and development of the Giant Copper (Canam) property; and enabled the company to gain 100 per cent ownership of the Giant Soo (Estella) lead-zinc property.

Minewise the record is equally impressive. When operation commenced in 1959, ore reserves were estimated at 745,000 tons grading 1.16% nickel and 0.39% copper. At September 30, 1968, end of the company's last fiscal year, the reserve was calculated at 897,241 tons grading 0.96% nickel and 0.52% copper. The reserve has since been assessed at more than one million tons with a grade of 0.95% nickel and 0.50% copper. The increase has resulted from follow-up drilling in the 4,300 and 4,600 orebodies. Recent drill holes have cut widths in excess of 60 feet with assays up to 2% nickel

and 1.5% copper, although such are not claimed as being representative.

During the summers of 1967 and 1968, Sumiko Consultants and the Japan Consulting Institute conducted a detailed surface geological and geochemical examination. This work disclosed the presence of five new mineralized areas, which contain 20 local areas of interest. Two of the anomalies sampled to date have yielded values exceeding 1% nickel and 1% copper.

A continuing geological study is being made by Walter E. Clarke, B.Sc., consulting geological engineer, and an interesting interpretation is presented in this issue of Western Miner, commencing on page 40.

DEVELOPMENT PROGRAMME

The following excerpt from the report of president J. Austin to shareholders, dated May 15, 1969, describes the situation:

"Under a continuing programme of ore-reserve development there has been an increase in total reserves during the past six months by 20 per cent to a total proven and probable tonnage reserve in excess of one million tons grading 0.95% nickel and 0.50% copper.

"In February 1969, the Directors authorized detailed geological studies with a view to developing a major exploration programme having as its objective a substantial increase in ore reserves on the property within the next two years to permit a target of 3,000 tons-per-day milling capacity to be achieved.

"The first stage of this major exploration programme will be started within the next six weeks and will consist of a programme of long-hole drilling to explore the favourable ore host ultra-basic formations for 1,000 to 1,500 feet to the north and south of the adit levels. It is this type of long-hole diamond drilling that successfully located the 4,300 and 4,600 zones which have developed large tonnages of spectacular high-grade ore in recent months.

"The first phase of this programme, consisting of some 40 holes aggregating 50,000 feet, will be undertaken on the 3,550 and 3,275 levels at an approximate cost of $350,000. The second phase, involving essentially the same footage, will be concentrated above and below the 2,600 main-haulage level.

"As this programme is supplementary to the normal diamond-drilling programme of some 50,000 feet annually, electric drills will be employed. This will be the first time that electric machines have been used for underground exploration in British Columbia and will eliminate the need to install additional compressed-air capacity at the property.

"To further assist in developing new ore zones, the programme of re-evaluating and postulating new hypotheses on the ore controls that was strated two years ago with the re-geologizing of the surface exposures, has been extended to the underground workings during recent months with promising results."

PRODUCTION

To May 31, 1969, Giant Mascot Mines milled 3,041,726 tons of ore and produced 38½ million pounds of nickel and 17½ million pounds of copper. The concentrator is currently operating at 1400 tons daily, five days a week. All concentrate is hauled to the terminal facilities of Vancouver Wharves Ltd. in North Vancouver in company-owned trucks and trailers.

As to mining methods and practice, Frank Holland, resident manager, states:

"Mining and extraction methods, although undergoing continuing evolution and refinement, in the search for greater efficiencies, are the tried and tested methods of previous years. That this approach is sound is indicated by the relatively stable cost position in the face of continually climbing labour and supply costs".

At last report the total complement was 185, including 29 members of staff; 20 men in the concentrator and crushing plant; 27 on surface and in shops, including underground maintenance; 4 on concentrate haulage; and 150 men in the mine.

Actually the present complement is above the average figure. Extra geological, engineering, and supervisory personnel are carried on staff to provide for resumption of activity at the Giant Copper operation. Also development and drilling crews are at an all-time high as a result of the increase in these activities. Supervision of the Giant Copper project is made from the Giant Mascot office at Hope. The accounting office, headed by George Audet, performs the bulk of the accounting procedures for all Giant Mascot operations as well as those of the subsidiaries G. M. Explorations Limited and Giant Explorations Limited.

PERSONNEL

Senior personnel of the company includes: W. C. Gibson, chairman of the board; J. Austin, president; L. P. Starck, P.Eng., vice-president and managing director; M. E. Davis, vice-president, finance.

Walter E. Clarke, B.Sc., P.Eng., of Vancouver is the company's geological consultant.

Senior operating personnel includes: Frank Holland, resident manager; George Bosnich, general and concentrator superintendent; John Hungle, mine superintendent; Orvil Gilroy, surface and mechanical superintendent; Len Allan, senior mining engineer; John Yu, chief mine engineer; G. Audet, chief accountant; and L. DeRoux, chief geologist.

E. R. Gayfer, P.Eng., chief engineer, supervises the company's field crews through Giant Explorations Limited.

Other supervisory mine personnel includes: M. Cawston, B. Woodin, and A. Kuiack, mine foreman; C. Martindale, diamond-drill foreman; and A. Gannon, Tom Smith, D. Cook, Ted Smith, Wm. Stark, and R. Klyne, shift bosses.

Engineering and geological personnel under the general direction of Len Allan includes: S. C. Yu, B.Sc., chief mine engineer; F. Elek, C.E., mine engineer; B. G. Hawkins, chief surveyor; J. Haight, B.Sc., and I. Murray, B.Sc., geologists; D. Botfield, surveyor; R. Harrison, draughtsman and surveyor; and Martin Ould, B.Sc., ventilation and noise-control engineer.

In the concentrator, H. Tice and J. Wadsworth are foremen. D. Thornbury is mechanical electrical foreman and C. Walther is surface foreman.

The accounting staff under George Audet includes: Mrs. L. Kirilows, assistant accountant; Mrs. A. Taylor, timekeeper; Mrs. J. Roberts, stenographer; and Walter Inouye, warehouseman and purchasing agent.

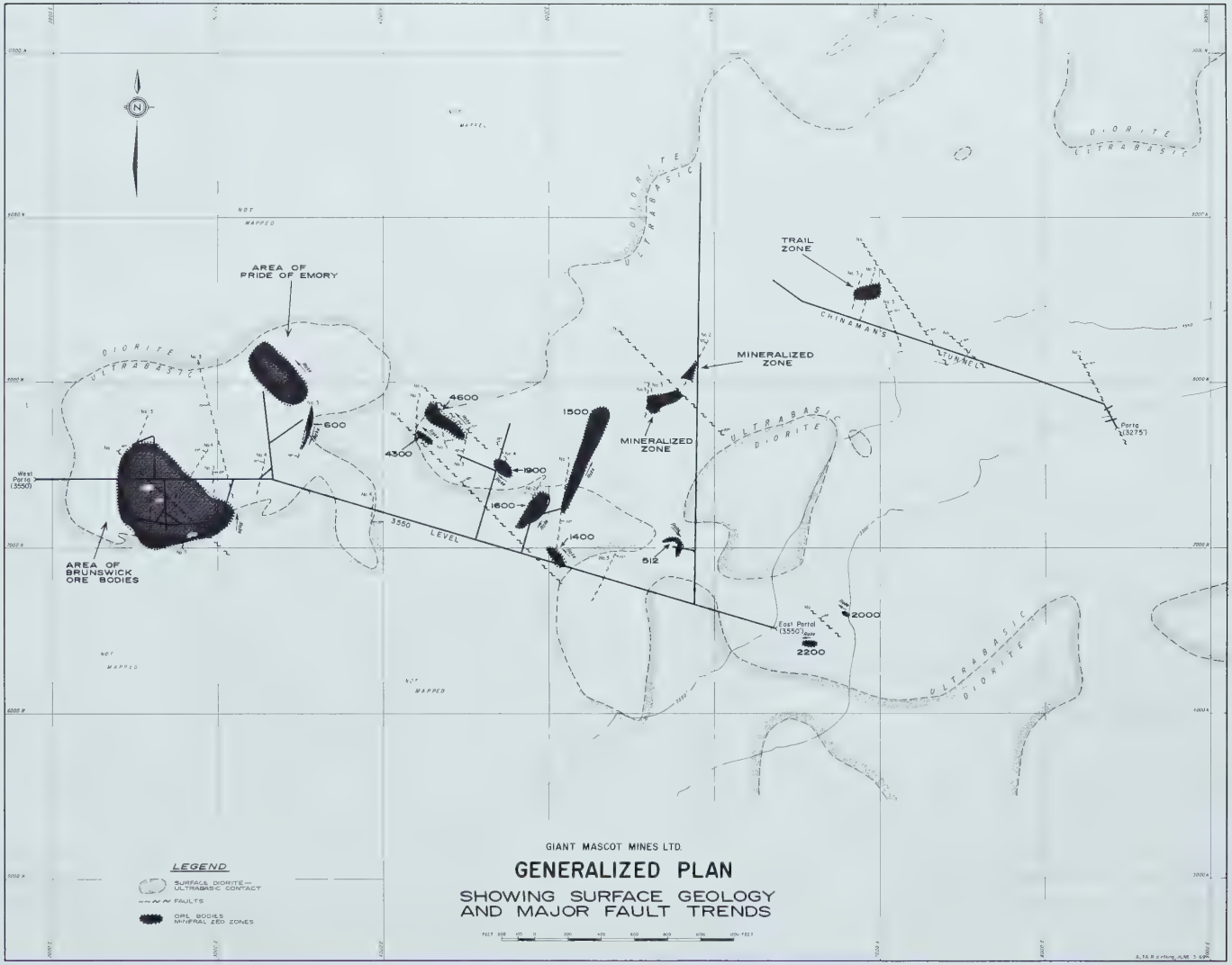
CONCLUSIONS

In this day of big-tonnage, multi-million-dollar mining projects, the continuous success and expansion, of the modest-tonnage, moderate-grade operations of Giant Mascot Mines prove there is still room for the smaller operation if handled by competent personnel. It is interesting to note that almost without exception, any staff member who has left the company has gone on to a position of responsibility and authority in the mining industry; an observation which could indicate that such conventional procedures as those employed at Hope provide valuable experience in mine supervision.

The assistance of L. P. Starck, Walter E. Clarke, and in particular Frank Holland, is gratefully acknowledged in the preparation of this report.

Above, **Back Row,** from left: L. L. Allan, senior engineer; G. H. Audet, chief accountant; O. Gilroy, surface and mechanical superindent; Frank Holland, resident manager; and J. Austin, president. **Centre Row,** from left: J. Hungle, mine superintendent, and L. DeRoux, geologist. **Front Row,** from left: L. P. Starck, vice-president and managing director; G. Bosnich, general superintendent; M. M. Menzies, director; and J. Yu, chief engineer.

Below, **Back Row,** from left: T. McLaren, chief assayer; D. Black, assistant assayer; R. K. Rogers, bucker; J. Haight, geologist; G. H. Audet, chief accountant; L. DeRoux, geologist; L. Allan, senior engineer; and E. Elek, long-hole engineer. **Front Row,** from left: W. Inouye, warehouseman; R. Harrison, draughtsman; Mrs. L. Kirilows, assistant accountant; Mrs. A. Taylor, timekeeper; Mrs. J. Roberts, stenographer; J. Yu, chief engineer; and D. Botfield, surveyor.



GIANT MASCOT MINES LTD.

GENERALIZED PLAN

SHOWING SURFACE GEOLOGY AND MAJOR FAULT TRENDS

GEOLOGY AND ORE CONTROLS

By WALTER E. CLARKE, B.Sc., P.Eng.

Walter E. Clarke

The author is a 1939 graduate of Queen's University in geology and mineralogy. From 1939 to 1941 he was assistant geologist for Buffalo Ankerite Gold Mines at South Porcupine, Ontario, and for the following four years was overseas in the Royal Canadian Engineers. On discharge, he returned to Buffalo Ankerite and was chief geologist until 1951. From 1952 to 1954 he was general superintendent of United Keno Hill Mines at Elsa, Yukon, with responsibility for all underground operations. In 1955, he was chief geologist of Geco Mines Limited at Manitouwadge, Ontario. From 1956 to 1959, Mr. Clarke was mine manager of the uranium project of Rayrock Mines Limited west of Yellowknife, N.W.T., and for the following six years he worked out of Rayrock's Toronto office as exploration manager with responsibility for Canadian and foreign projects. In 1966, Mr. Clarke established his own consulting practice in Vancouver. He is a registered professional engineer in the provinces of British Columbia and Ontario and is a member of the Canadian Institute of Mining and Metallurgy.

SUMMARY

The information presented in this report is based on the work of several geologists whose opinions have been summarized, where appropriate, in the body of the report, and preliminary interpretive work by the writer, over a period of three months. The primary conclusion drawn is that structure has played an important role in the control of ore bodies, and this approach should be a major consideration in planning future exploration. It is fully recognized that much more work is required to validate the present interpretations and investigate other geological conditions that may contribute to the control of ore deposition.

In general it is believed that all the intrusive rocks currently identified on the property are differentiates of the same basic-ultrabasic magma. The implications of this hypothesis are that nickel-bearing ultrabasic masses may be located within areas currently considered to be underlain by the unproductive dioritic and noritic facies of the intrusive complex, thereby appreciably increasing the potential of the property as a whole.

All rock types have been cut by faults which can be placed into four main groups, all related to known regional fault structures. The areas of intersection of N45° to 50°W striking faults and N10°W to N30°E striking faults appear to exert control over ore deposition. The northwest trend is considered to be the most important as mineralized areas and peridotite masses favour this direction. However, ore shoots have been localized along the northeasterly trending fault structures.

Time has not permitted investigation of the obvious spatial distribution of ore shoots relative to embayments in and proximity to the diorite and norite. The study of the chemical and mineralogical environment of the ore bodies is almost certain to make an important contribution to the overall interpretation of ore controls.

REGIONAL GEOLOGY

The mine is situated in a norite-diorite ultrabasic complex along the eastern edge of a granite, granodiorite and diorite intrusive mass, which is related to the Coast Range Batholith and the belt of acid intrusives extending southerly into Washington State. These rocks intrude northerly trending regionally metamorphosed Paleozoic sediments.

One of the main structural features of the Hope area is a regional northwesterly trending fault zone which extends from Lillooet southeasterly down the Fraser River to Boston Bar, to a point ten miles due east of Hope and thence on strike into Washington. The serpentine band along this fault signifies the strength of this structure. Parallel faulting has been observed at Laidlaw, ten miles west of Hope, and its northerly extension may be generally inferred by a series of serpentine and ultrabasic masses as far north as Cogburn Creek to the east of Harrison Lake. Northeasterly trending faults have been mapped at Laidlaw, as far southeast as the Giant Copper property, and probably are represented by Emory, Yale, Cogburn Creeks, etc. Prominent north-south faulting probably related to the main Fraser River fault occurs about midway between the mine and the Fraser River and marks the contact of the Paleozoic and Mesozoic rocks in this area. All of these fault directions have been recognized underground at the mine.

Of more than passing interest is a northwesterly trending zone of fracturing associated with ore bodies at

both the Giant Mascot and Giant Copper properties, which on the regional surface picture may be represented by the Nicolum Creek-Sumallo River valleys from Hope to the Giant Copper property to the southeast. In a northwesterly direction, the trend is from Hope through the Giant Mascot mine and thence to the ultrabasic masses south of Cogburn Creek.

GEOLOGY OF THE PROPERTY

The surface extent of the main ultrabasic intrusive mass is approximately 1.8 miles in an east-west direction, by 1.4 miles north-south. At least three satellite ultrabasic bodies have been located; two 2,000 and 10,000 feet northwesterly and one 3,000 feet south of the main mass. The most detailed geological information has been obtained from production underground workings in the westerly third of the main intrusive complex, where the north-south dimensions decrease to between 1,000 and 2,500 feet.

The rock classification currently accepted at the mine is the result of several years' experience and the investigation of a number of geologists. The complex relationships and sometimes gradational transitions from one rock type to another, characteristic of intrusive masses of this type, lead to many incongruities, which are yet unresolved. For convenience, the rock types are categorized into ultrabasics, feldspathic and metamorphic rocks.

Ultrabasic Rocks
- Peridotite
- Pyroxenite
  - Bronzititic pyroxenite
  - Hornblende pyroxenite
    - Medium-grained hornblende pyroxenite
    - Poikilitic hornblende pyroxenite
- Hornblendite

Feldspathic Rocks
- Norite
- Diorite

Metamorphic Rocks
- Schist
- Hornfels
- Quartzite.

ULTRABASIC ROCKS

Peridotite

This rock is black in color and composed mainly of fine grained olivine crystals with more or less hornblende and pyroxene. The hornblende, where present, is usually in the form of large crystals which enclose olivine and pyroxene giving a poikilitic appearance. A peridotite composed entirely of olivine and therefore classed as dunite is found in a few localities. Crumbly alteration is characteristic of peridotites and is commonly in close proximity to ore bodies, although the alteration frequently exhibits no well defined boundaries, grades into fresh rock and is not obviously related to any structural feature, contact or later intrusion. The main alteration appears to be the development of talc along cracks and grain boundaries and patchy flakes of biotite. The peridotite frequently grades into pyroxenite with no visible contact. Some ore bodies are within peridotite masses.

Pyroxenites

The general classification includes the non-feldspathic rocks in which pyroxene is the major constituent, hornblende may vary considerably, and olivine is not recognizable. The following three types are the most common, but gradational phases can make differentiation difficult.

Bronzititic Pyroxenite.

Composed mainly of fine grained, equigranular brown pyroxene (bronzite) with minor hornblende content. The rock is very hard and tough. It may be mineralized with fine grained disseminated sulphides or may be completely barren. Classification may be difficult in border phases with diorite and the absence or presence of feldspar may be the only criterion to classify the rock as a pyroxenite or diorite.

Hornblende Pyroxenite

The medium-grained hornblende pyroxenite as the name implies is a felted mass of hornblende and pyroxene crystals in varying proportions with little or no olivine. The rock is hard and very tough, dark green to black and may be a host for ore bodies.

The poikilitic pyroxenite is similar to the above noted pyroxenite except that it contains many large crystals of hornblende. It may also be a host for ore.

Hornblendite

There are probably at least two types of hornblendite. The larger masses are composed almost entirely of equidimensional black hornblende crystals and usually occupy contact zones between pyroxenite and diorite. In some areas scattered sulphides have been noted, but no ore bodies have been found within this rock type.

Hornblendite dykes are found cutting all rock types on the property including crumbly alteration zones of the peridotite. The composition and texture of the dyke filling varies from fine grained black hornblende to pegmatitic hornblende with feldspar and is normally unmineralized.

FELDSPATHIC ROCKS

Norite

The mineral composition of this rock type is pyroxene and plagioclase feldspar in very variable proportions, giving a colour range from greyish through brown to green. In some areas, the feldspar is pinkish, thought to be the result of included ferric oxide. The rock is usually medium to fine grained and the pyroxenitic varieties exhibit gradational contacts with pyroxenite. Sulphide mineralization similar to that found in the main ultra-basic mass, may be present but in other areas the rock may be totally unmineralized and no ore occurs in this formation.

Diorite

This rock type is a variable mixture of hornblende and plagioclase feldspar, coarse to fine grained, and in some instances may exhibit gneissic structure. The colour varies from gray to greenish to brownish, depending upon the mineral composition. The brownish variety is usually equigranular, medium to fine grained and the presence of feldspar is the only megascopic characteristic distinguishing this from fine grained bronzititic pyroxenite. The rock is not a host for ore.

METAMORPHIC ROCKS

There are at least three types of metamorphic rocks, namely schist, hornfels and quartzites. The latter two types have been described by other geologists from surface examination, and have not been recognized by the writer in the underground workings. The hornfels are described as massive, black to dark brownish grey, very fine grained and compact. Some hornfels contain porphyroblastic crystals of brown pyroxene. The quartzites are light to dark grey, massive, an equigranular aggregate of fine to medium-grained quartz and feldspar crystals.

On surface, the schists are platey, schistose, greenish in colour and contain granular crystals of dark reddish brown garnet. Underground, the areas mapped as schist vary considerably in appearance, rarely contain garnets, but are well foliated with the development of sericite and biotite. The rocks are so highly metamorphosed that positive identification of the original rock type is difficult.

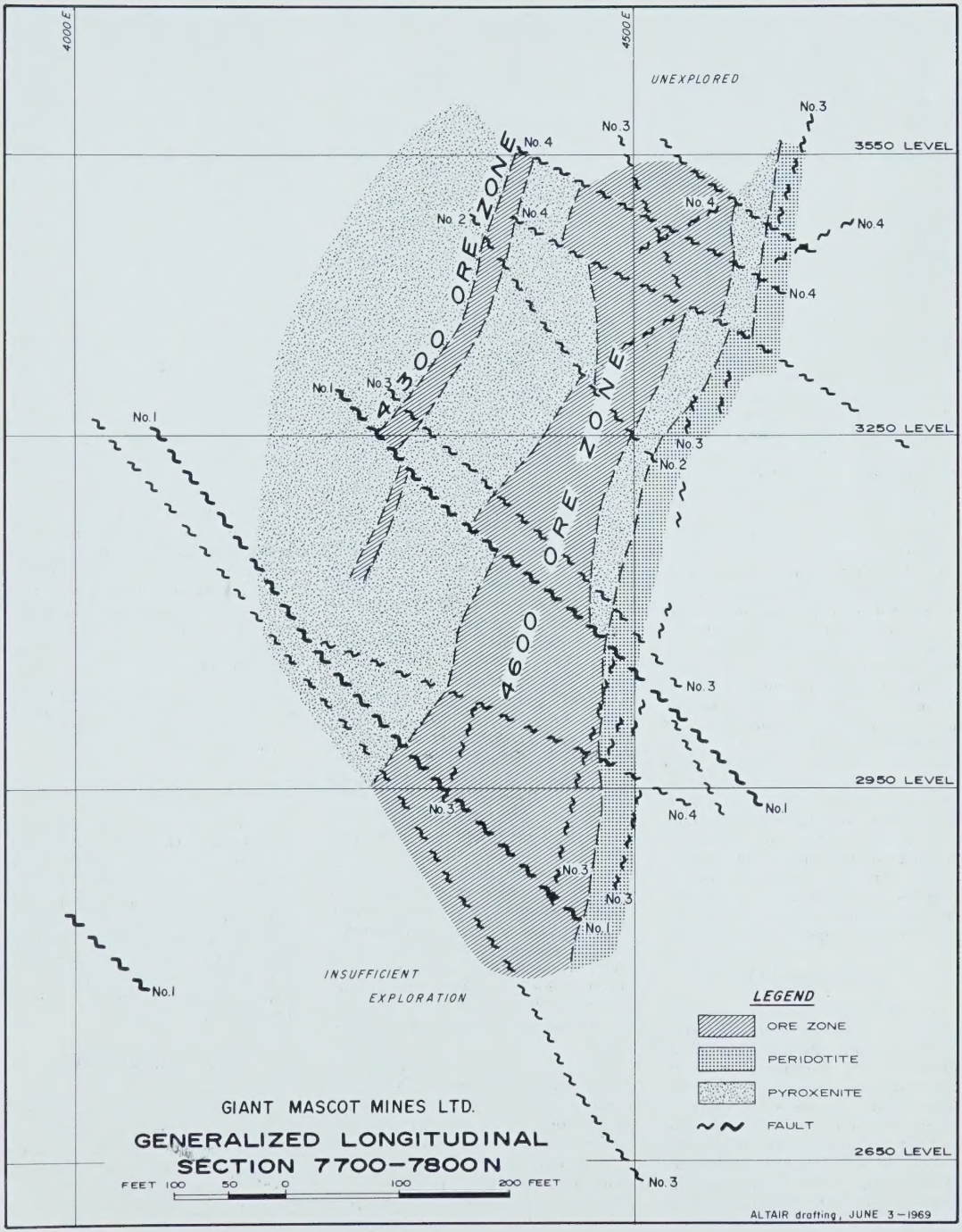
PETROGRAPHY

No comprehensive petrographic study of the various rock types has been carried out to date, but work

done by Dr. P. A. Peach and others has brought to light significant characteristics of the intrusive complex.

Dr. Peach found that the pyroxenites are a local differentiation of peridotite. The diorites were classified as gabbro due to the calcic feldspar. The pyroxene in the diorite was the same composition as that in the ultrabasic facies, and he concluded that this rock type is a late differentiate of the magma which produced the peridodites. None of the rock types examined showed signs of secondary alteration, and the changes of olivine to serpentine and magnetite and of augite to hornblende took place during the initial crystallization history of the rocks, the process of autometamorphism.

Further petrographic work will aid



in determining the age relationships between the various rocks in the intrusive complex, an important hypothesis for establishing geological limits for exploration.

MINERALIZATION

Economic sulphide mineralization may be conveniently classified as disseminated or massive. Mineralogical studies by R. M. Thompson and A. R. Graham show the following average percentage sulphide content for the two types.

Sulphide	Disseminated Ore Ore to Gangue 1:3	Massive Ore
Pyrrhotite	45%	55%
Pentlandite	25%	30%
Violarite	10%	—
Pyrite	10%	10%
Chalcopyrite	5%	5%

In the disseminated ore, the sulphide minerals are interstitial to the silicates in the host rock and undoubtedly crystallized after the silicate minerals. Pyrrhotite is reasonably fresh, but pentlandite is partly converted to highly friable violarite. Secondly pyrite veinlets cut all other minerals and occasionally form replacement intergrowths with minor chalcopyrite.

In the massive sulphides, heavily fractured coarse pentlandite shows mutual boundaries with the massive host pyrrhotite. Under high magnification, small ragged exsolution laths of pentlandite are found in pyrrhotite, probably accounting for a considerable portion of the nickel content of pyrrhotite. Both sulphides are traversed by late pyrite veinlets, apparently following rehealed planes of shearing. Chalcopyrite is in irregular patches, associated sometimes with pyrite or as discrete areas on the contact of massive pentlandite with pyrrhotite, and apparently is later than both the latter two minerals. Chalcopyrite also occurs with mutual boundaries with minor pyrrhotite in fractures in pentlandite, as if some pyrrhotite continued to form during late stages of sulphide crystallization.

ALTERATION

As noted above, there is very little evidence of secondary alteration within the intrusive complex. Exceptions to this are the development of secondary actinolite, talc, chlorite, serpentine and in some cases magnetite, in direct association with shearing and faulting, and development of talc and biotite in the "crumbly alteration" areas mainly within peridotites. The cause of this latter alteration type is obscure as the alteration is not obviously related to any structural feature, contact or later intrusion.

The presence of greater than normal percentages of hornblende in pyroxenites in close proximity to some ore bodies suggests the metamorphism of pyroxene to hornblende, but until further petrographic work is done, this can only be speculative.

FAULTING

(Reference Maps No. 1 and No. 2)

Widespread faulting is in evidence throughout the underground workings and the main fault trends are tentatively categorized as follows:

Group	Strike	Dip
1	N45° - 50°W	50° -75°N.E
2	N15° - 30°E	70°S.E.-70°N.W
3	N10°W- 10°E	55°E. -55°W.
4	N30°W-N30°E	20° -30°E or W

The faults included in No. 1 group are closely associated with several of the main bodies and partially explored mineralized areas, and may be related to the regional northwesterly trending zone postulated as extending from the Giant Copper property to the southeast, through Giant Mascot and northwesterly to the ultrabasics at Cogburn Creek. At least four such fault systems have been recognized, each of which in all probability is made up of several parallel or subparallel discontinuous strands, across a total width up to 300 feet to 400 feet. The main systems are located in the Brunswick ore bodies area; along the trend of the 1400, 1900, 4600 and possibly Pride of Emory ore shoots; a mineralized area in 512 crosscut on the 3550 level; the Trail zone in the Chinaman's Tunnel, 3275 level. Elements of this fault type have been found to dam or cut off mineralization, and provide a favourable structural environment for important ore extensions of the 4600 ore body. It is concluded that these faults are pre-ore in age, with minor post-ore movement.

The faults of the second group are most readily recognized by their close association with tabular ore bodies exemplified by the 600 and 1600, and the mineralized zone in 512 crosscut.

The faults of No. 3. Group are probably closely related to those of No. 2. They are common to all mineralized zones examined, and are frequently more readily recognizable in disseminated ore zones or host rocks, as within massive sulphides they may only be identified as discontinuous joints displaying similar attitudes. In some cases, massive ore blocks within a general mineralized area will be bounded by such fracture planes, while in other cases there has been no obvious affect on the ore outline. Movement along this fault direction is exhibited by the development of talc, a condition which might cause damming of ore solutions. These faults are probably related to the regional system which has been observed on surface two miles east of the mine.

The above three fault systems appear to have combined to set up complicated zones of fracturing, favourable to the concentration of sulphides.

Faults of the 4th group are quite strong in appearance, usually associated with 8 inches to 2 feet of crushed wall rock and gouge material and often characterized by the introduction of feldspathic and carbonate minerals, with bleaching of the crushed material. It is believed that these faults are later in age than the other three groups, and exhibit post ore movement. While not observed by the writer, it is reported that certain ore shoots, for example the 600 and 1500, terminate against such structures. The offset portions of these ore shoots have not yet been located, so the direction or amplitude of movement are unknown. These faults are probably related to the northwesterly trending Fraser River regional thrust fault system.

There are other fracture systems on all levels, exhibiting varying attitudes, the correlation of which has not yet been attempted.

FOLDING

No folds as such have been recognized to date. The occurrence of faulting and fracturing, with parallel strikes but opposing dips, may indicate the presence of former folds, dome structures or other zones of disturbance or weakness, which exerted control over the distribution of the intrusives. Much additional interpretive work is necessary to substantiate this idea.

ORE CONTROLS

The recognition of ore controls is of primary importance, as compared to the extent of the basic to ultrabasic intrusive complex known ore bodies are relatively small. The problem has been studied by geologists over the past several years, but as yet is unresolved.

Eric S. Cheney and Ian M. Lange in their paper "Evidence for Sulphurization and the Origin of Some Sudbury-Type Ores", May 1967, considered the relevancy of this hypothesis as it relates to the Mascot ore bodies. The sulphurization hypothesis suggests that any mafic intrusion carrying at least trace amounts of nickel, copper or cobalt may contain ore at or near its contacts. Large ore bodies may be restricted to those intrusions containing more siliceous differentiates exhibiting gradational, sharp, and mutually crosscutting contacts with the principal rock types. Exploration should be directed towards finding these differentiates and intersections of former permeable (dilation) zones with the most nickel-rich portion of the intrusions.

A. R. Graham, as the result of his mineralogical study of Mascot ore, concludes:

"The ore-bearing bodies appear to be ultrabasic masses, high in sulphur, intruded as a crystal mush, lubricated by a considerable proportion of relatively high-nickel sulphide fluid. This silicate-sulphide magma was probably formed by differentiation at depth, and intruded into its present position under a thick cover to prevent much sulphur loss by degassing. Late movement after almost complete solidification of the composite fluid provided dilation zones into which the interstitial sulphides were probably filter-pressed to form the high-grade massive bodies.

G. E. P. Eastwood states: "that the localization of ore appears to have been controlled largely by the chemistry and physical chemistry of the rocks and of the processes to which they have been subjected."

A. E. Aho believes that all dykes, faults and fractures and the related alteration are post-ore and consequently have no control over ore deposition.

E. R. Gayfer, Chief Engineer, Giant Mascot Mines Limited, made a geometrical analysis of the shapes of horizontal sections of the ore bodies and concluded that the shape of each ore body could be related to three, or in some cases four intersecting fracture planes.

The widespread faulting in evidence throughout the underground workings impressed the writer during early examinations. The faults, although individually of minor intensity with probably little post-ore movement, show distinct continuity and the relationships of intersecting fault systems with known ore bodies and mineralized zones presented interesting implications. Despite the conflicting opinions summarized above, it is believed that an interpretation of the fault patterns will lead to a better understanding and possibly a solution of ore controls. The study is still in a very preliminary stage, but certain structural conditions appear worthy of continued investigation. The characteristics and some of the effects of the fault systems have been referred to in the preceding section under "Faulting".

The N45° to 50°W trending fault systems are considered to represent the final adjustments along pre-ore structures which provide channelways for the intrusion of the ultrabasic and basic magma differentiates, including sulphide minerals. On a regional basis, ultrabasic and nickeliferous showings may be traced along this trend from Hope to Cogburn Creek. Within the mine area, there is lineation of ore bodies, zones of mineralization and, less obviously, masses of peridotite, along four such parallel trends. In detail individual ore bodies are controlled at least in part, by recognizable fault strands of this system.

The generally north-south striking faults with dips in excess of 50°, which may include the faults in both groups No. 2 and 3, represent the next most important structural trend. As with the northwesterly trending structures, these faults may represent the final adjustments along pre-ore zones of weakness, and in the case of the 600 and 1600 ore bodies have provided access for the introduction of ore solutions. In the 4600 ore body, a N10°E striking fracture system marks the southeast extremity of the ore zone, which has been traced from below the 2950 level to the 3550 level. N10° to 20°W shears mark massive sulphide interconnections between parallelling northwesterly mineralization trends.

As further evidence of the importance of faulting, it has been noted that ore bodies may occur in both peridotite or pyroxenite, with the only obvious reason for selectivity in any area being the presence of one or both of the above fault systems. The plunges or rakes of ore bodies mined to date show a marked variation in attitude, even within the same ore body. It appears possible that such variation may be explained by the change of ore control from one fault system to another.

Detailed analysis of former producing areas is hampered by inaccessibility and lack of detailed structural information, but it is anticipated that the continuing study of the 4600 zone will provide many answers to the problem of ore controls.

The possibility of the flatly dipping group No. 4 fault offsetting or otherwise interrupting the continuity or ore shoots must be considered and investigated in more detail.

The general conclusions are that structural control of ore bodies is a distinct possibility and until further evidence qualifies this interpretation, the intersection of the N50°W and generally north-south striking fault systems within the ultrabasic rocks constitute areas most amenable to ore deposition.

ACKNOWLEDGEMENTS

The writer wishes to thank the President and Directors of Giant Mascot Mines Limited for permission to publish this report, and in particular Mr. F. W. Holland, Resident Manager, for his assistance and background information based on several years operating experience. Also acknowledged are the contributions made by H. Otsu, M. Kiyokawa, S. Ishihara of Sumiko Consultants and Japan Consulting Institute; Aaro Aho; R. M. Thompson; Eric S. Cheney and Ian M. Lange; A. R. Graham; P. A. Peach and G. E. P. Eastwood through their reports on varying aspects of the mine geology.

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